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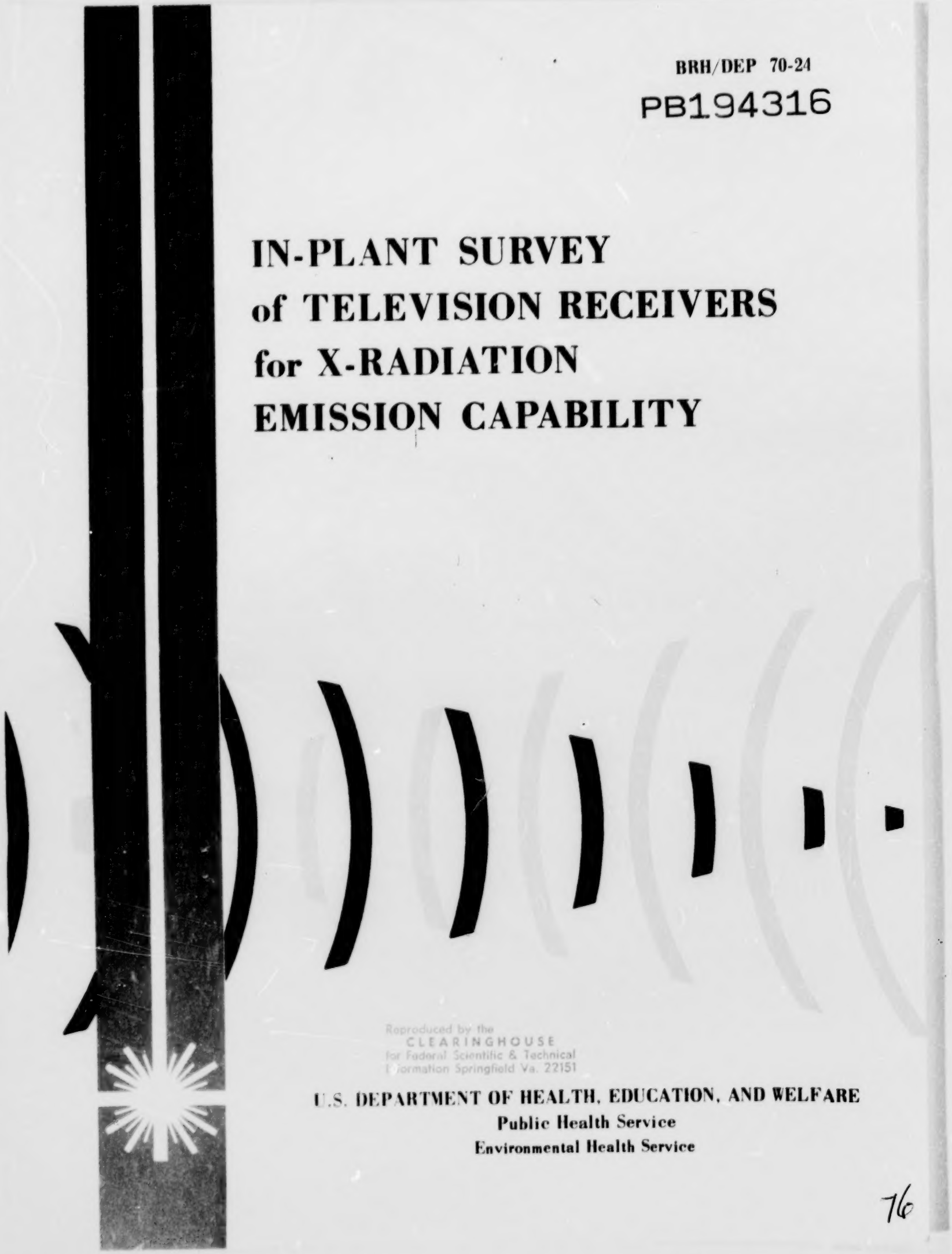
IN-PLANT SURVEY of TELEVISION RECEIVERS for X-RADIATION EMISSION CAPABILITY



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76

DIVISION OF ELECTRONIC PRODUCTS

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(continued on inside of back cover)

BRH/DEP 70-24

IN-PLANT SURVEY of TELEVISION RECEIVERS for X-RADIATION EMISSION CAPABILITY

Conducted

June 1969 - September 1969

D.R. Smith, S.E. Reiter, and T.M. Smith

Intelligence Branch
Division of Electronic Products

September 1970

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Environmental Health Service
Bureau of Radiological Health
Rockville, Maryland 20852

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FOREWORD

The Bureau of Radiological Health, formerly the National Center for Radiological Health, continues to carry out a national program designed to reduce the exposure of man to hazardous ionizing and nonionizing radiation.

Within the Bureau, the Division of Electronic Products (1) develops and administers performance standards for radiation emissions from electronic products, (2) studies and evaluates emissions of and conditions of exposure to electronic product radiation and intense magnetic fields, (3) conducts or supports research, training, development, and inspections to control and minimize such hazards, and (4) tests and evaluates the effectiveness of procedures and techniques for minimizing such exposures.

The Bureau publishes its findings in Radiological Health Data and Reports (a monthly publication), Public Health Service numbered reports, appropriate scientific journals, and technical report series for the Bureau's divisions, offices, and laboratories.

The technical reports of the Division of Electronic Products (DEP) allow comprehensive and rapid publishing of the results of intramural and contractor projects. The reports are distributed to State and local radiological health program personnel, Bureau technical staff, Bureau advisory committee members, university radiation safety officers, libraries and information services, industry, hospitals, laboratories, schools, the press, and other interested individuals. These reports are also included in the collections of the Library of Congress and the Clearinghouse for Federal Scientific and Technical Information.

I encourage the readers of these reports to inform the Bureau of any omissions or errors. Your additional comments or requests for further information are also solicited.

John C. Villforth
Director
Bureau of Radiological Health

PREFACE

Section 365(a) of the Radiation Control for Health and Safety Act of 1968 authorizes the Secretary of the Department of Health, Education, and Welfare to establish and carry out an electronic product radiation control program designed to protect the public health and safety from electronic product radiation. As part of such a program, the staff of the Division of Electronic Products, from June 1969 to September 1969, visited the facilities of 21 domestic television manufacturers and one retailer of foreign receivers. These visits were made to measure x-radiation emissions from television receivers considered typical of those being marketed since October 18, 1968, the effective date of the Radiation Control for Health and Safety Act. The tests made on the receivers covered a range of operating conditions, including various adjustments to the television sets that could result in the emission of x radiation under conditions expected to be found during home use.

The data collected during these visits to the manufacturers provided basic information on the capability of each manufacturer's receivers to emit x radiation under certain operating conditions. The data also provided information used in the development of the performance standard for television receivers.

In carrying out the in-plant tests, the Division of Electronic Products receiver the full cooperation of the domestic television industry. Each manufacturer made available information on current production receivers for appropriate sample selection, and they also provided personnel to assist during the tests.

Robert L. Elder, Sc.D.
Director
Division of Electronic Products

ACKNOWLEDGEMENT

Grateful appreciation is expressed by the Division of Electronic Products, Bureau of Radiological Health, to the Electronic Industries Association and the participating manufacturers and distributors for their help in making this survey possible. Thanks is also expressed to the personnel from the Northeastern Radiological Health Laboratory, Southeastern Radiological Health Laboratory, and Southwestern Radiological Health Laboratory who particpated in this survey.

CONTENTS

	Page
FOREWORD	iii
PREFACE	v
TABLES	viii
ABSTRACT	ix
1. INTRODUCTION	1
2. TEST PROCEDURE	3
3. SELECTION OF RECEIVERS FOR ADDITIONAL LABORATORY TESTS	5
4. RESULTS	7
4.1 DATA SUMMARY	7
4.2 OPERATING CHARACTERISTICS DATA	9
5. RECOMMENDATIONS	12
REFERENCES	13
APPENDIX A - LOCATIONS OF COMPANIES VISITED DURING THE 1969 IN-PLANT SURVEY	31
APPENDIX B - PROCEDURES USED DURING 1969 IN-PLANT SURVEY FOR TESTING COLOR TELEVISION RECEIVERS FOR X-RADIATION EMISSIONS	35
APPENDIX C - DATA CONTROL SYSTEM FOR THE IN-PLANT SURVEY OF TELEVISION RECEIVERS FOR X-RADIATION EMISSION CAPABILITY	39
APPENDIX D - CODES FOR LOCATION OF METER	69

TABLES

1. X-radiation emission capability for domestically manufactured receivers 15

2. X-radiation emission capability for foreign manufactured receivers that are sold by domestic manufacturers 17

3. Maximum x-radiation readings from television receivers tested during the 1969 in-plant survey . 19

4. Comparison of extrapolated field test results with requirements of the television standard 23

5. Number of additional tests performed on domestic receivers that exhibited x-ray exposure rates in excess of 0.5 mR/hr 26

6. Number of additional tests performed on foreign receivers that exhibited x-ray exposure rates in excess of 0.5 mR/hr 28

ABSTRACT

Visits were made to the facilities of 21 domestic television manufactuers and one retailer of foreign receivers to measure x-radiation emissions from television receivers considered typical of those being marketed since the effective date of the Radiation Control for Health and Safety Act of 1968. The test data obtained during these visits provided basic information on the capability of the receivers to emit x radiation under certain operating conditions, including various adjustments to the receivers that could result in x-radiation emission under conditions expected to be found during home use. The information was used in the development of the performance standard for television receivers and also in the development of recommendations for future programs of compliance testing under the performance standard.

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IN-PLANT SURVEY OF TELEVISION RECEIVERS FOR X-RADIATION EMISSION CAPABILITY

1. INTRODUCTION

From May 1968 to December 1968 staff members of the Bureau of Radiological Health (BRH), with the cooperation of the Electronic Industries Association, made visits to design, production, and research facilities of 19 domestic television manufacturers (1). These visits were made to obtain information needed for continuing an effective program of x-radiation emission control and for drafting performance standards for television receivers. The information obtained indicated that there were identifiable and correctable deficiencies in the x-radiation control programs of the television industry. X-ray emission test records made by the manufacturers showed that the receivers, at the time of manufacture, were meeting the x-ray exposure requirements established by the individual manufacturers under their test conditions. The manufacturers, however, were not performing the additional evaluation and testing of receivers necessary to ensure that there was no excessive x-radiation exposure under various conditions of receiver operation and service that might be encountered during home use. After the adoption on October 18, 1968, of the Radiation Control for Health and Safety Act of 1968, an additional effort was required to evaluate the current production of each manufacturer.

The home surveys of color television receivers conducted by local health agencies and the Public Health Service (2) and quality control measurements performed by the manufacturers, had used the recommendation of the National Council on Radiation Protection and Measurements (3) as the standard by which x-ray exposure levels from television receivers were judged. The NCRP recommended that "the exposure rate at any readily accessible point 5 cm from the surface of any home television receiver shall not exceed 0.5 mR/hr under normal operating conditions." However, one cannot assume that the emission from any single set will stay reasonably constant for an extended period. Changes in line voltage, user, or service control settings, and the failure and repair of sets may cause increases in x-radiation emission.

Meetings between BRH staff members and members of the Electronic Industries Association's Ad Hoc Committee on Color Television resulted in plans to test television receivers sold by domestic manufacturers at either the manufacturer's final assembly production facility or a designated distribution point (4). The need for such tests and the development of testing procedures to assess compliance of television receivers

with pending performance standards had been discussed at Hearings before the Subcommittee on Public Health and Welfare of the Committee on Interstate and Foreign Commerce, House of Representatives (5).

In carrying out the responsibilities of the Radiation Control for Health and Safety Act, the Division of Electronic Products (DEP) initiated a survey and test program on television receivers currently being produced by domestic manufacturers to determine whether these receivers are capable of emitting excessive x radiation. The tests were made on models that had been marketed since October 18, 1968, and were conducted at the manufacturing facilities of 21 domestic manufacturers and one retailer of foreign receivers from June 1969 to September 1969.

After the survey was completed, a performance standard (6) for television receivers that defines the conditions under which receivers are to be tested was proposed and put into effect pursuant to Section 358 of the Radiation Control for Health and Safety Act. The television standard establishes measurement and test conditions for x-radiation emission from color television receivers that require manipulation of service and user control settings and tests with conditions identical to those that result from component or circuit failure which will maximize x-radiation emission from the receiver.

There are three phases of the television standard that deal with test conditions. These phases are described in Subpart C, paragraphs 78.210 (C) (3) (i), (ii), and (iii) of the standard. Phase I (i) became effective on January 15, 1970, and states ". . . measurements shall be made with all user controls adjusted so as to produce maximum x-radiation emission from the receiver." Phase II (ii) became effective on June 1, 1970, and states ". . . measurements shall be made with all user controls and all service controls adjusted to combinations which result in the production of maximum x-radiation emissions." Phase III (iii) will become effective on June 1, 1971, and states ". . . measurements shall be made under the conditions described in subdivision (ii) of this subparagraph, together with conditions identical to those which result from that component or circuit failure which maximizes x-radiation emissions."

The findings of the survey conducted by DEP have been compared to the standard, although such a comparison was not in the original protocol or intended purpose of the project.

2. TEST PROCEDURE

The field tests on the television receivers were performed at the plant locations listed in appendix A by a three-man team from BRH. Each manufacturer provided an appropriate area with adequate facilities for the testing and evaluation of the receivers. The sample receivers were selected from either packaged models of the receiver or end-of-line production, depending on the availability of chassis designs and models. At least one model of each distinct chassis design (electrical and mechanical) and certain monochromatic set designs that were in production or had been produced since October 18, 1968, were tested.

Each manufacturer had been requested by letter to prepare a listing of current (since October 18, 1968) chassis and models, including the following information: model numbers for each chassis design; make and model numbers of picture tubes; high-voltage settings for each model receiver; make and model numbers of high-voltage rectifier and shunt regulator tubes (if used); and model numbers of receiver cabinets with a description of their sizes and construction materials. The listings were used by the survey teams to make initial selections either from the assembly lines or warehouse facilities of the manufacturers.

The first selection criteria was to choose color receivers (domestic and imports) over monochrome receivers (domestic and imports). Color receivers were given a higher priority because the high voltages - generally 25,000 volts or more - required for color picture tube operation can generate x rays which may leak from the receiver. Monochrome receivers operate at lower picture tube voltages and are less likely to emit x rays. Within these two groups (color receivers and monochrome receivers) the selection criteria, in order of priority, were as follows:

a. Circuitry Affecting Radiation: Select one receiver of each type of circuitry which could affect radiation emission.

b. High-Voltage Power Supply: Give a higher priority to circuits with shunt regulator tubes than those without, and give those with vacuum tube high-voltage rectifiers a higher priority than those with solid-state rectifiers.

c. Operating High Voltage: For each separate electrical circuit, give the highest priority to that receiver with the highest specified operating voltage.

d. Picture Tube Size-Type: Test each separate electrical circuit with several sizes of picture tubes. Give the highest priority to the largest size picture tubes. Specify the manufacturer of the picture tube on the data sheet.

e. Cabinet Type: Give the highest priority to receivers with the smallest containment volume. Give a higher priority to wood and plastic cabinets than to metal cabinets.

After the selection was made, the BRH team listed the manufacturer, assembler, or importer of the receiver chassis and the numbers on the receiver or chassis that identified the designs, layouts, and date of manufacture. The following information was compiled for each receiver selected for testing: model type (including cabinet style, serial number, and date code); description of the receiver chassis (including the size, manufacturer, and model number of the cathode ray tube); description of the regulation system for the high-voltage supply; and identification by manufacturer and model number of high-voltage shunt regulator and rectifier tubes, if used.

The receiver tests were designed to identify television receivers which, by nature of their design, layout, and complement of components, are capable of emitting excessive x radiation, especially under conditions that can be expected to occur during home use.

The tests on each of the receivers included:

a. Measurement of the ranges of high voltage and current capable of being sustained in each x-ray producing component as functions of line voltages, adjustments of user controls, adjustments of service controls, and other operating parameters.

b. Measurement of x-ray exposure rates at accessible locations on the outer surfaces of the receiver.

c. Measurement of the x-ray exposure rates at accessible locations on the outer surfaces of the receiver with a defective shunt regulator tube substituted for the original shunt regulator tube. (This is a well-known failure mode for shunt-regulated receivers.)

The procedures followed in performing the tests on the sample receivers are listed in appendix B. All aspects of the tests performed on the receivers were documented on data forms (see appendix C, pages 45 through 49).

3. SELECTION OF RECEIVERS FOR ADDITIONAL LABORATORY TESTS

When receivers were identified during the in-plant survey as being capable of emitting excessive x radiation, a determination was made as to whether a receiver should be selected for additional laboratory tests. The tests on these receivers were expected to confirm the field results and identify changes needed to reduce or eliminate x-radiation emissions.

The purchase of the receivers for laboratory tests was based on the following considerations:

a. Receivers which showed x-radiation emission capabilities above 0.5 mR/hr under the field test conditions and for which operating characteristics data had been obtained were considered for purchase. Recommendations made by teams in the field were reviewed by BRH engineers, based on these criteria and on the resulting operating data curves, to make the selections.

b. In some instances several receivers of the same chassis design (with different picture tube sizes) might meet criteria as stated in (a) above. The receiver selected for purchase was the one giving the highest radiation readings.

c. The actual receiver purchased was, in most instances, the one which was tested and found to emit x radiation in excess of 0.5 mR/hr under some portion of the test conditions. Reasons for not purchasing the receiver which had been tested were:

(1) A component of the receiver had been destroyed during testing.

(2) Changes were made on the receiver subsequent to the testing.

(3) The selection of the receiver for purchase was made at a later date, and the original receiver tested could not be located. In instances where the receiver which was tested could not be obtained, an identical model was purchased.

d. Receivers exhibiting x-ray exposure rates above 0.5 mR/hr during tests with a defective shunt regulator tube and not during the other test procedures generally were not selected for additional testing.

Twenty-two receivers were selected on the basis of the foregoing criteria as representative of most sets that the in-plant survey showed to be capable of emitting more than 0.5 mR/hr. These 22 receivers were subjected to additional laboratory tests, the results of which are detailed in reference (7).

4. RESULTS

4.1 DATA SUMMARY

Data from each of the individual manufactuers were processed in accordance with the data control system described in appendix C.

Results of the in-plant tests were sent to each of the companies visited. A number of observations from the x-ray tests performed industry-wide are summarized below to indicate the extent of x-radiation emission capability shown by the receivers under the various test conditions.

During the visits to the manufacturers, 352 receivers (domestic and foreign) were tested. Of these, 89 were monochrome receivers and 263 were color. No monochrome receiver was found to emit x-ray exposure rates in excess of 0.5 mR/hr. Eighty of the 263 color television receivers exhibited x-radiation emissions at or above 0.5 mR/hr during one or more of the tests at a recorded line voltage of 135 VAC. At a recorded line voltage of 130 VAC, only 28 receivers exhibited x-radiation emissions above 0.5 mR/hr. Fifty-seven of the 352 receivers were of foreign manufacture; these models represented eight foreign manufacturers and three foreign subsidiaries of domestic manufacturers. Ten of the 57 foreign receivers exhibited x-ray exposure rate capabilities at or above 0.5 mR/hr under various conditions of test, including a line voltage of 135 VAC, and four exhibited x-radiation emissions of 0.5 mR/hr or more at recorded line voltages of up to 130 VAC.

Table 1 summarizes the results of the x-radiation emission capabilities of the domestically manufactured receivers, and table 2 summarizes the results of the x-radiation emission capabilities of the receivers made by foreign manufacturers. In table 3 the maximum x-radiation readings are listed for those receivers that emitted more than 0.5 mR/hr during the tests. The conditions of test and location of the readings are also given.

For receivers designed to operate from supply voltages of 117 to 120 VAC, the standard requires tests at voltages up to and including 130 VAC. Some of the measurements in the field survey were taken at a line voltage of 135 VAC. If these measurements had been taken at a line voltage of 130 VAC, the values for measured x-ray exposure rates would have been approximately one-half of those taken at 135 VAC (7). Extrapolating this relationship, the field data can be used to determine whether receivers would or would not meet the provisions of the television standard when tested at a line voltage of 130 VAC, even though the field measurements were made at 135 VAC.

Comparison of the field test results with the television standard (6) indicates the following:

a. All 89 monochrome receivers tested would have met Phases I and II of the television standard. All 89 would have met Phase III for the one mode of failure tested.

b. All 263 color receivers tested would have met Phase I of the standard.

c. Thirteen color television receivers without shunt regulator tubes and 15 color television receivers with shunt regulator tubes would not have met Phase II of the standard.

d. Thirty-four color receivers would not have met Phase III of the standard.

Table 4 lists by manufacturer the number of receivers that would not have met the various phases of the television standard.

The information given in tables 5 and 6 regarding the tests performed on the television receivers indicates to some extent the sources of x rays in the receivers. When x-ray exposure rates greater than 0.5 mR/hr were measured from the picture tube and/or the shunt regulator tube, operating tests, picture tube tests, and shunt regulator tube tests were made on the receiver to determine the operating parameters, such as voltage and current for the receiver components, necessary to produce 0.5 mR/hr. Tests were made on the shunt regulator tube when values of x radiation were measured on a location of the receiver near that source. If a non-operative shunt regulator tube resulted in x-ray exposure rates greater than 0.5 mR/hr from the receiver, then the defective shunt regulator tube test was made on the receiver in order to determine voltage and current characteristics for the picture tube under this failure mode.

4.2 OPERATING CHARACTERISTICS DATA

The various operating tests were run on a receiver after the initial survey of the receiver showed that it was capable of emitting x radiation. To properly evaluate the x-ray emitting capabilities of a television receiver, at least three tests were run, assuming the receiver had a shunt regulator tube. These tests were designed to measure the high-voltage regulation and operating conditions of the receiver, x-ray emissions from the picture tube, and x-ray emissions from the shielded shunt regulator tube. Tests on the rectifier tube and its shielding were desirable, but at the time of the visits no valid method for field test had been developed, because generally the rectifier tube develops its x-ray emitting characteristics only after some use. Incidental radiation from the rectifier tube was noted on some report forms as a possible source of x rays during many of the tests on the shunt regulator tube because of its proximity to the shunt regulator tube. Curves were developed from the operating conditions data to illustrate the relationship for the specific component; these curves show corresponding values of high voltage and current that produce a constant exposure rate.

Using information derived from plots of operating condition data and knowing the manufacturer's recommended operating conditions (high voltage and line voltage), it was possible to see the maximum high voltage and currents attainable for a given line voltage for the receiver.

The shunt data obtained at 0.5 mR/hr were plotted to determine whether or not radiation above the standard could be detected from a shunt regulator tube operated in the receiver. The shielding could be considered inadequate when the x-radiation emissions could be identified as being entirely from the shunt regulator tube. In many instances radiation measured in the location of the shunt regulator tube could be identified from the graphs as originating more probably from a combination of sources such as rectifier tube, picture tube, and shunt regulator tube.

The picture tube data (defective shunt) were plotted to show the relation between voltage (Vp) and current (Ip) for the picture tube at 135 VAC line. By knowing the radiation emitted at maximum conditions with the defective shunt test and using this plot, other radiation data can be calculated at different values of picture tube current (Ip).

The picture tube data obtained at 0.5 mR/hr were plotted to determine whether the picture tube would emit radiation in excess of 0.5 mR/hr.

As an example let us consider a test of one particular receiver. In figure 1, the graph of "Picture Tube Data at 0.5 mR/hr" shows the conditions of picture tube voltage and current that result in an x-ray exposure rate of 0.5 mR/hr from the picture tube. Any combination of voltage and current on or greater than the 0.5 mR/hr line would result in at least 0.5 mR/hr of radiation. It is necessary to determine what conditions of line voltage and high voltage produce picture tube voltages and currents that result in x-ray exposure rates at or above the 0.5 mR/hr line. The solution for one receiver is given by the graphs of typical operating conditions (high voltage settings 1 through 5) in figure 1.

More specifically, in this test, all points on the 0.5 mR/hr line represent a picture tube voltage of at least 30 kV. With high voltage settings 1 and 2, regardless of the line voltage up to 135 VAC, none of the operating conditions gave a picture voltage of 30 kV. Thus, we can say that regardless of the line voltage (that is, from 110 to 135 volts), the receiver would not emit 0.5 mR/hr, as long as the high-voltage setting is at positions 1 or 2. These are arbitrary settings, designated only for test purposes.

Looking at the plot for high-voltage setting 3, it can be observed that with line voltages of 125, 130, or 135, it was possible to obtain a picture tube voltage of 30 kV or more. Next, we must determine whether the current was large enough on any of these lines to correspond to a condition on the 0.5-mR/hr line.

Going back to the 0.5-mR/hr line, we see that at 30 kV the current was 0.52 mA. This condition is met by a single point on the operating conditions line corresponding to a line voltage of 135. Thus, it appears that with high-voltage setting 3 and with a line voltage of 135 VAC, the receiver was just barely capable of emitting 0.5 mR/hr. The graph for high-voltage setting 4 shows that 0.5 mR/hr or more could be obtained at that setting with line voltages of 125 or greater. The next graph indicates that adjusting the high voltage setting to its extreme limit of 5 had no greater effect on the radiation emission than did setting 4.

The illustrated procedure of evaluating the graphs is valid for receivers where all rectifier current passes through the picture tube; that is, receivers that do not have shunt regulator tubes. If the receiver does have a shunt regulator tube, the graphs of 0.5 mR/hr, from the picture tube or the shunt regulator tube, cannot be compared directly to the "Typical Operating Conditions" graph. The reason is that in shunt-regulated receivers, the voltages and milliamperages given are for the regulation of the receiver and not for the voltage and milliamperage capabilities of the individual part such as the picture tube or shunt regulator tube. Additional information would be needed to compare the two graphs.

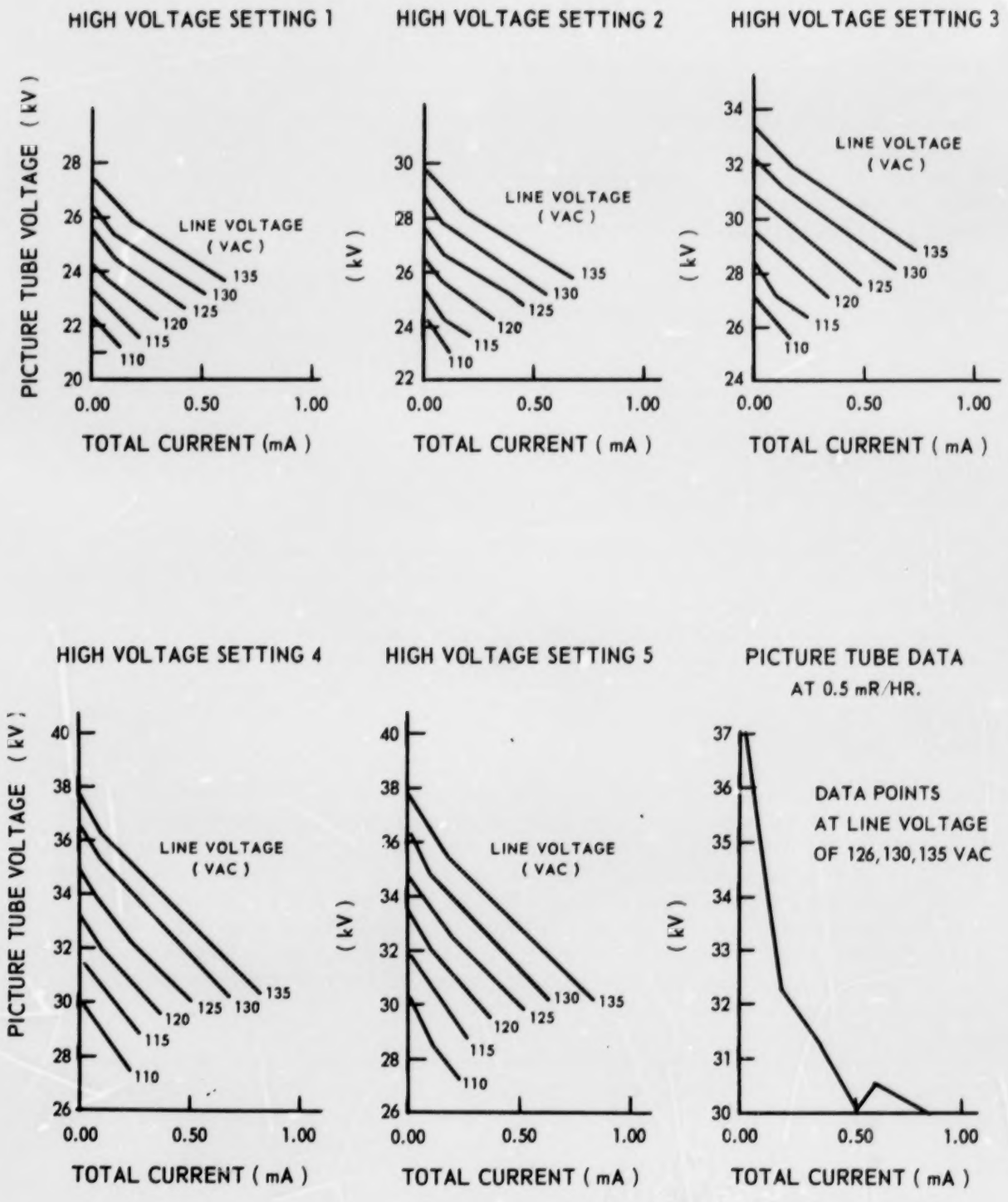

Figure 1. Typical operating conditions and picture tube data for one of the television receiver tests.

5. RECOMMENDATIONS

(1) As a result of the in-plant survey, it was recommended that a program be established to provide for review on a regular basis of the results of the current quality control programs carried out by the television manufacturers. Included in the recommendations was a review of the test programs and the data that the manufacturers must submit to show their products are in conformance with the established standard. Such a program has been initiated.

(2) The x-radiation emission capability tests were run on new receivers, and for shunt-regulated receivers, with a single component failure. Additional usage or age-condition tests and other failure conditions should be developed for future testing and evaluation of receivers to determine the change in x-radiation emission capability.

(3) Adequate testing procedures intended to estimate the x radiation from rectifier tubes in use should be developed for both quality control of tube supplies and for receiver testing.

(4) The television standard requires a maximum line voltage of 130 volts for tests of x-radiation emission. Increasing the line voltage to 135 volts during the in-plant survey increased the number of color receivers capable of emitting excessive x radiation from 28 to 40 receivers. A study should be undertaken to determine the extent and period of time that line voltages of 130 volts or greater could be expected to be encountered in homes in the United States during use of the receivers.

(5) Development of mobile field units would facilitate testing and evaluation of television receivers at the factory or warehouse. The tests made by these units would indicate the significance of changes in receiver design and would ensure that procedures established under certification programs are being carried out and that changes in x-radiation emission conditions for various model receivers are documented, preferably prior to marketing of the products. Another in-plant survey designed to obtain this type of information is planned for the latter part of 1970.

(6) A product survey incorporating testing procedures similar to those used in this study was recommended for imported television products not sold by domestic manufactuers. The limited number of foreign receivers tested in this survey does not include all foreign manufactuers or their receiver designs. Such a program is being planned with the cooperation of the Bureau of Customs.

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Table 1. X-radiation emission capability for domestically manufactured receivers.

Manufacturer or brand name	Receivers surveyed (color and monochrome)	Monochrome receivers surveyed[a]	Color receivers indicating x-radiation emission capability under all test conditions[b]		Color receivers selected for additional testing
			≤130 VAC	≤135 VAC	
Admiral	18	2	7	7	2
Andrea	3	1	2	2	1
Conrac	18	12	0	2	0
Curtis Mathes	5	0	0	4	1
Dumont Emerson	14	2	2	5	2
General Electric	22	5	1	6	1
Hoffman	9	1	1	4	0
Magnavox	37	4	1	3	1
Motorola	14	5	0	1	1
Olympic	7	1	2	5	0
Packard Bell	4	0	1	1	0
Philco-Ford	14	1	0	1	0

[a]No monochrome sets indicated x-radiation emission above 0.5 mR/hr.

[b]Test conditions are detailed in appendix B.

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Table 1. X-radiation emission capability for domestically manufactured receivers (continued).

Manufacturer or brand name	Receivers surveyed (color and monochrome)	Monochrome receivers surveyed[a]	Color receivers indicating x-radiation emission capability under all test conditions[b]		Color receivers selected for additional testing
			≤130 VAC	≤135 VAC	
RCA					
Bloomington, Ind.	25	0	0	4	0
Memphis, Tenn.	17	14	0	1	0
Setchell Carlson	11	1	3	5	4
Sylvania	15	3	0	4	0
TMA	18	3	2	12	3
Warwick	9	1	0	0	0
Wells Gardner	8	1	2	3	1
Westinghouse	3	1	0	0	0
Zenith	24	8	0	0	0
TOTAL	295	66	24	70	17

[a]No monochrome sets indicated x-radiation emission above 0.5 mR/hr.

[b]Test conditions are detailed in Appendix B.

Table 2. X-radiation emission capability for foreign manufactured receivers that are sold by domestic manufacturers.

Foreign receivers sold by domestic manufacturers	Receivers surveyed (color and monochrome)	Monochrome receivers surveyed[a]	Color receivers surveyed	Color receivers indicating x-radiation emission capability under all test conditions[b]		Color receivers selected for additional testing
				≤130 VAC	≤135 VAC	
Admiral						
Hitachi	1	1	0	0	0	0
Taiwan	1	1	0	0	0	0
Curtis Mathes						
Nippon	5	3	2	0	1	1
Sanyo	5	1	4	0	1	0
Dumont Emerson						
Hitachi	1	0	1	0	0	0
Osaka-Onkyo	1	1	0	0	0	0
Sanyo	1	0	1	0	1	0
General Electric						
Hitachi	1	1	0	0	0	0
Motorola						
Hayakawa	1	0	1	0	0	0
Olympic						
Nippon Columbia	4	0	4	4	4	2
Packard Bell						
Matsushita	10	4	6	0	2	1
Philco Ford						
Taiwan	1	1	0	0	0	0
Toshiba	1	0	1	0	1	0

[a]No monochrome television receivers exhibited x-radiation emission capability above 0.5 mR/hr.

[b]Test conditions are detailed in appendix B.

(continued on following page)

Table 2. X-radiation emission capability for foreign manufactured receivers that are sold by domestic manufacturers (continued).

Foreign receivers sold by domestic manufacturers	Receivers surveyed (color and monochrome)	Monochrome receivers surveyed[a]	Color receivers surveyed	Color receivers indicating x-radiation emission capability under all test conditions[b]		Color receivers selected for additional testing
				≤130 VAC	≤135 VAC	
Sears, Roebuck, Co.						
Sanyo	6	2	4	0	0	0
Toshiba	8	2	6	0	0	1
Sylvania						
Sylvania Far East Ltd.	1	1	0	0	0	0
Symphonic						
Sanyo	3	1	2	0	0	0
Television Manufacturers of America						
Taiwan	1	1	0	0	0	0
Westinghouse						
Westinghouse of Canada	5	3	2	0	0	0
TOTAL	57	23	34	4	10	5

[a]No monochrome television receivers exhibited x-radiation emission capability above 0.5 mR/hr.

[b]Test conditions are detailed in appendix B.

Table 3. Maximum x-radiation readings from television receivers tested during the 1969 in-plant survey.

Manufacturer and test no.	Model no.	Maximum reading (mR/hr)[a]	Picture tube voltage (kV)	Picture tube current (mA)	Shunt tube current (mA)	Line voltage (VAC)[b]	Location of meter[c]
Admiral							
0402	3L3139	3.0[e]	35.8	0.38	0	135	FR-4
0403	2L501	4.2[f]	36.8	0.22	none	135	FR-1
0404	8T331C	10.0[f]	36.1	0.37	none	135	FR-4
0408	3L361W	2.1[f]	37.5	0.32	none	135	FR-1
0409	3L3139	2.6[e]	37.0	0.24	0	135	FR-4
0414	8T331C	2.3[f]	33.7	0.25	none	135	FR-1
0416	2L515	2.4[f]	38.0	0.25	none	135	FR-5
Andrea							
2201	SPECTRA	1.7[e]	37.7	0.25	0	135	FR-5
2202	SPECTRA	3.9[e]	39.3	0.32	0	135	FR-2
2203[d]	SPECTRA	0.7[f]	34.2	0.51	0.10	135	FR-5
Conrac							
1801	CYB21	3.2[e]	33.2	0.30	0	135	FR-5
1806	CYB21	1.0[e]	31.4	0.22	0	135	FR-5

[a]All readings are in mR/hr measured at 5 cm, except those marked with an asterisk; * = Stoms readings (1,000 counts per minute).

[b]The performance standard for television receivers requires tests at line voltages including a maximum of 130 VAC. The maximum readings in the third column, if taken at 130 VAC, would be approximately one-half those taken at 135 VAC in most instances.

[c]Codes for meter locations are explained in appendix D.

[d]Test 2203 on same receiver as test 2201, except with a 6BK4C shunt regulator tube.

[e]Readings taken with high voltage setting at maximum, defective shunt regulator tube in receiver.

[f]Readings taken with high voltage setting at maximum.

(continued on following page)

Table 3. Maximum x-radiation readings from television receivers tested during the 1969 in-plant survey (continued)

Manufacturer and test no.	Model no.	Maximum reading (mR/hr)[a]	Picture tube voltage (kV)	Picture tube current (mA)	Shunt tube current (mA)	Line voltage (VAC)[b]	Location of meter[c]
Curtis Mathes							
0501	52M742	3.4[e]	38.3	0.41	0	135	FR-5
0502	52M742	4.7[e]	34.8	0.32	0	135	FR-5
0506	52M524	0.5[e]	33.7	0.34	0	135	FR-5
0507	52P544	2.3[e]	33.0	0.32	0	135	FR-5
0509	51P504	0.7[e]	26.8	0.16	0	135	FR-5
0517	52M594	3.0[f]	23.6	1.05	none	135	BK-3
Dumont Emerson							
0206	55C29	1.8[e]	32.6	0.22	0.05	135	FR-5
0207	26C56W	7.0[e*]	34.1	0.35	0.10	135	BK-9
0212	35P04	4.5[e*]	25.0	0.25	0.05	135	BK-7
0213	59T01W	1.1[f]	28.8	0.34	none	135	TP-5
0217	22C04	25.0[f]	35.0	0.35	0.04	135	FR-5
0218	22C04	4.5[f]	29.8	1.24	0.06	135	LT-4
General Electric							
0701	M924EPN	1.3[e]	34.5	0.34	0	135	FR-2
0703	M920EWD	0.7[e]	34.3	0.42	0	135	FR-5
0704	M920EWD	1.6[e]	34.7	0.63	0	135	FR-5
0722	M926EMP	0.6[f]	31.0	1.03	0.13	135	FR-1
0723	M926EMP	2.8[e]	35.6	0.36	0	135	FR-5
0724	M926EMP	1.2[e]	35.7	0.26	0	135	FR-5
Hoffman							
1404	GC112420A	0.6[f]	31.4	0.25	none	135	FR-5
1405	GC117420B	11.0[e*]	34.7	0.03	0	135	TP-2
1406	GC117420B	7.8[e*]	34.3	0.16	0	135	TP-2
1409	GC117420B	1.8[e]	33.0	0.20	0	130	FR-5
Magnavox							
0619	1C6254	1.7[f]	28.6	0.20	0	135	TP-2
0633	1C6402	2.8[f]	33.0	0.27	0.05	132	FR-5
0637	1C6816	0.5[e]	31.5	0.46	0	135	FR-5

(continued on following page)

Table 3. Maximum x-radiation readings from television receivers tested during the 1969 in-plant survey (continued).

Manufacturer and test no.	Model no.	Maximum reading (mR/hr)[a]	Picture tube voltage (kV)	Picture tube current (mA)	Shunt tube current (mA)	Line voltage (VAC)[b]	Location of meter[c]
Motorola							
0108	CT665EW	0.5[f]	31.0	0.50	none	135	FR-5
Olympic							
1201	CC5401	0.8[f]	32.5	0.20	none	135	FR-6
1202	CK5413	15.0[e]*	32.1	0.40	0.05	135	FR-5
1203	CC3382	1.4[f]	30.6	0.33	none	135	BK-4
1205	CT400	3.6[f]	27.0	0.30	none	135	BK-1
1206	CT911	2.6[f]	27.4	0.30	none	135	BK-4
1207	CC5402	1.1[f]	33.5	0.40	0.01	135	FR-5
1209	CC382	1.5[f]	30.7	0.43	none	135	BK-4
1210	CT911	1.6[f]	26.8	0.31	none	135	BK-4
1211	CT400	1.2[f]	26.4	0.20	none	135	BK-3
Packard-Bell							
0804	CQ942	4.2[e]	37.4	0.50	0	135	FR-5
0809	CQ322	0.6[f]	24.4	0.42	none	135	TP-4
0810	CQ322	0.9[f]	24.6	0.41	none	135	TP-4
Philco-Ford							
1004	C5540TWA	0.5[f]	30.5	0.27	none	135	FR-5
1012	S5102WA	5.8[e]*	26.4	0.10	0	135	BK-1
RCA (Bloomington)							
1301	FM477W	9.0[e]	36.7	0.24	0	135	FR-5
1302	FM477W	3.2[e]	32.0	0.35	0	135	FR-2
1323	GL706FR	2.8[e]	37.5	0.34	0	135	FR-3
1324	GL706FR	1.1[e]	36.7	0.14	0	135	FR-2
RCA (Memphis)							
2317	GM579W	1.0[f]	35.1	0.32	0.19	135	FR-5

(continued on following page)

Table 3. Maximum x-radiation readings from television receivers tested during the 1969 in-plant survey (continued).

Manufacturer and test no.	Model no.	Maximum reading (mR/hr)[a]	Picture tube voltage (kV)	Picture tube current (mA)	Shunt tube current (mA)	Line voltage (VAC)[b]	Location of meter[c]
Setchell-Carlson							
0901	3100	1.0[f]	30.0	0.25	none	135	FR-8
0903	2400	9.5[f]*	31.3	0.18	0	135	BK-4
0904	2200	6.8[e]	35.6	0.35	0.07	135	FR-5
0905	3000	4.0[e]	36.2	0.28	none	120	LT-5
0907	9M6903B	5.6[e]*	39.2	0.24	0	120	FR-2
Sylvania							
0305	CF504W1	0.6[f]	32.4	0.66	0.22	135	FR-5
0306	CF505K1	0.7[f]	33.1	0.73	0.25	135	FR-5
0307	CFNP22	0.7[f]	32.2	0.72	0.36	135	FR-4
0308	CFNP20BT	0.4[f] (8.0)*	31.6	0.83	0.28	135	FR-4
TMA							
1501	6-102-2	0.4[e] (9.8)*	32.6	0.20	0	135	FR-5
1502	2181	6.0[e]	38.5	0.10	0	135	FR-5
1503	1480	2.9[e]	35.5	0.38	0	135	FR-1
1504	5381	1.2[e]	36.4	0.25	0	135	FR-5
1505	2481FP	5.9[e]	38.7	0.24	0	135	FR-5
1506	1581-2	5.0[e]	36.2	0.16	0	135	FR-5
1508	5381	2.8[e]	37.3	0.24	0	135	FR-5
1509	2481FP	0.6[e]	32.7	0.23	0	135	FR-5
1512	6-102-2	0.2[e] (7.0)*	37.5	0.60	0	135	FR-5
1513	2181	9.6[e]	37.1	0.43	0	135	FR-5
1514	1480	11.0[e]	37.0	0.28	0	135	FR-5
1515	9120	1.3[f]	34.3	0.24	none	135	FR-5
Wells Gardner							
1101	G12K380064	5.4[e]*	53.2	0.45	0	135	FR-5
1102	E13K410066	60.0[e]*	36.6	0.28	0	130	BK-6
1108	E13K410066	2.8[e]	37.8	0.20	-	130	FR-5

Table 4. Comparison of extrapolated field test results with requirements of the television standard.

Manufacturer and type	No. of receivers tested	No. of receivers that would not meet the standard at a maximum line voltage of 130 VAC or less[a]		
		Phase I	Phase II	Phase III
Admiral				
monochrome	4	0	0	0
color-nonshunt	14	0	0	0
color-shunt	2	0	0	0
Andrea				
monochrome	1	0	0	0
color-nonshunt	0	0	0	0
color-shunt	2	0	2	2
Conrac				
monochrome	12	0	0	0
color-nonshunt	3	0	0	0
color-shunt	3	0	1	1
Curtis Mathes				
monochrome	4	0	0	0
color-nonshunt	1	0	1	0
color-shunt	10	0	2	3
Dumont Emerson				
monochrome	3	0	0	0
color-nonshunt	6	0	1	0
color-shunt	8	0	3	1
General Electric				
monochrome	6	0	0	0
color-nonshunt	6	0	0	0
color-shunt	11	0	2	4
Hoffman				
monochrome	1	0	0	0
color-nonshunt	4	0	0	0
color-shunt	4	0	0	1

[a]Tests performed at 135 VAC; results in these three columns extrapolated from 135 VAC data.

(continued on following page)

Table 4. Comparison of extrapolated field test results with requirements of the television standard (continued).

Manufacturer and type	No. of receivers tested	No. of receivers that would not meet the standard at a maximum line voltage of 130 VAC or less[a]		
		Phase I	Phase II	Phase III
Magnavox				
monochrome	4	0	0	0
color-nonshunt	13	0	1	0
color-shunt	20	0	1	1
Motorola				
monochrome	5	0	0	0
color-nonshunt	10	0	0	0
color-shunt	0	0	0	0
Olympic				
monochrome	1	0	0	0
color-nonshunt	8	0	6	0
color-shunt	2	0	1	0
Packard Bell				
monochrome	4	0	0	0
color-nonshunt	6	0	0	0
color-shunt	4	0	0	1
Philco Ford				
monochrome	2	0	0	0
color-nonshunt	13	0	0	0
color-shunt	1	0	0	0
RCA				
monochrome	14	0	0	0
color-nonshunt	13	0	0	0
color-shunt	15	0	0	4
Sears				
monochrome	4	0	0	0
color-nonshunt	4	0	0	0
color-shunt	6	0	0	0
Setchell-Carlson				
monochrome	1	0	0	0
color-nonshunt	5	0	0	0
color-shunt	5	0	3	3

[a]Tests performed at 135 VAC; results in these three columns extrapolated from 135 VAC data.

(continued on following page)

Table 4. Comparison of extrapolated field test results with requirements of the television standard (continued).

Manufacturer and type	No. of receivers tested	No. of receivers that would not meet the standard at a maximum line voltage of 130 VAC or less[a]		
		Phase I	Phase II	Phase III
Sylvania				
monochrome	4	0	0	0
color-nonshunt	4	0	0	0
color	8	0	0	0
Symphonic				
monochrome	1	0	0	0
color-nonshunt	0	0	0	0
color-shunt	2	0	0	0
TMA				
monochrome	4	0	0	0
color-nonshunt	1	0	1	0
color-shunt	14	0	0	8
Warwick				
monochrome	1	0	0	0
color-nonshunt	5	0	0	0
color-shunt	3	0	0	3
Wells Gardner				
monochrome	1	0	0	0
color-nonshunt	4	0	0	0
color-shunt	3	0	0	0
Westinghouse				
monochrome	4	0	0	0
color-nonshunt	4	0	0	0
color-shunt	0	0	0	0
Zenith				
monochrome	8	0	0	0
color-nonshunt	16	0	0	0
color-shunt	0	0	0	0
TOTALS	352	0	28	34

[a]Tests performed at 135 VAC; results in these three columns extrapolated from 135 VAC data.

Table 5. Number of additional tests performed on domestic receivers that exhibited x-ray exposure rates in excess of 0.5 mR/hr.

Domestic manufacturer	Tests on sets indicating x-ray emission above 0.5 mR/hr	Typical operating tests run	Additional tests run on picture tube		Additional tests run on shunt regulator tube		Additional test run on defective shunt regulator	
			≤130 VAC	≤135 VAC	≤130 VAC	≤135 VAC	≤130 VAC	≤135 VAC
Admiral	16	7	5	6	2	2	0	0
Andrea	8	2	1	2	2	2	0	2
Conrac	5	2	0	2	0	0	0	1
Curtis Mathes	10	3	0	2	0	2	0	4
Dumont Emerson	8	3	2	2	1	1	0	3
General Electric	9	2	0	1	1	1	0	5
Hoffman	4	1	0	1	0	0	1	2
Magnavox	6	2	1	1	1	1	0	2
Motorola	1	1	0	0	0	0	0	0
Olympic	11	4	1	4	1	1	0	2
Packard Bell	1	0	0	0	0	0	1	1
Philco-Ford	1	1	0	0	0	0	0	1
RCA								
Bloomington, Ind.	4	0	0	0	0	0	0	4
Memphis, Tenn.	1	0	0	0	0	0	0	1
Sears, Roebuck Co.	0	0	0	0	0	0	0	0

(continued on following page)

Table 5. Number of additional tests performed on domestic receivers that exhibited x-ray exposure rates in excess of 0.5 mR/hr (continued).

Domestic manufacturer	Tests on sets indicating x-ray emission above 0.5 mR/hr	Typical operating tests run	Additional tests run on picture tube		Additional tests run on shunt regulator tube		Additional test run on defective shunt regulator	
			≤130 VAC	≤135 VAC	≤130 VAC	≤135 VAC	≤ 130 VAC	≤ 135 VAC
Setchell Carlson	11	4	3	4	0	0	2	3
Sylvania	7	4	0	3	0	0	0	0
Symphonic	0	0	0	0	0	0	0	0
TMA	24	7	1	2	1	5	0	10
Warwick	0	0	0	0	0	0	0	0
Wells Gardner	5	1	0	1	0	0	2	3
Westinghouse	0	0	0	0	0	0	0	0
Zenith	0	0	0	0	0	0	0	0
TOTAL	133	44	14	31	9	15	6	46

Table 6. Number of additional tests performed on foreign receivers that exhibited x-ray exposure rates in excess of 0.5 mR/hr.

Foreign manufacturer	Tests on sets indicating x-ray emission above 0.5 mR/hr	Typical operating tests run	Additional tests run on picture tube		Additional tests run on shunt regulator tube		Additional tests run with defective shunt regulator tube	
			≤130 VAC	≤135 VAC	≤130 VAC	≤135 VAC	≤130 VAC	≤135 VAC
Admiral								
Hitachi	0	0	0	0	0	0	0	0
Taiwan	0	0	0	0	0	0	0	0
Curtis Mathes								
Nippon Electric	1	1	0	0	0	0	0	0
Sanyo	1	0	0	0	0	0	0	1
Dumont Emerson								
Hitachi	0	0	0	0	0	0	0	0
Osaka-Onkyo	0	0	0	0	0	0	0	0
Sanyo	1	0	0	0	0	0	0	1
General Electric								
Hitachi	0	0	0	0	0	0	0	0
Motorola								
Hayakawa	0	0	0	0	0	0	0	0
Olympic								
Nippon Columbia	8	4	4	4	0	0	0	0

(continued on following page)

Table 6. Number of additional tests performed on foreign receivers that exhibited x-ray exposure rates in excess of 0.5 mR/hr (continued).

Foreign manufacturer	Tests on sets indicating x-ray emission above 0.5 mR/hr	Typical operating tests run	Additional tests run on picture tube		Additional tests run on shunt regulator tube		Additional tests run with defective shunt regulator tube	
			≤130 VAC	≤135 VAC	≤130 VAC	≤135 VAC	≤130 VAC	≤135 VAC
Packard Bell								
Matsushita	4	2	0	2	0	0	0	0
Philco Ford								
Taiwan	0	0	0	0	0	0	0	0
Toshiba	1	0	0	0	0	0	0	1
Sears, Roebuck, Co.								
Sanyo	0	0	0	0	0	0	0	0
Toshiba	0	0	0	0	0	0	0	0
Sylvania, Sylvania Far East Ltd.	0	0	0	0	0	0	0	0
Symphonic								
Sanyo	0	0	0	0	0	0	0	0
Television Manufacturer of Amer.								
Taiwan	0	0	0	0	0	0	0	0
Westinghouse								
Westinghouse of Canada	0	0	0	0	0	0	0	0
TOTAL	16	7	4	6	0	0	0	0

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APPENDIX A

LOCATIONS OF COMPANIES VISITED DURING THE 1969 IN-PLANT SURVEY

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LOCATIONS OF COMPANIES VISITED
DURING THE 1969 IN-PLANT SURVEY

Dates	Company	Location
6/25 - 6/26	Philco-Ford	Philadelphia, Pa.
6/30 - 7/3	Motorola	Franklin Park, Ill.
6/30 - 7/3	Wells-Gardner	Chicago, Ill.
6/30 - 7/3	Emerson	Jersey City, N.J.
7/7 - 7/11	Sylvania	Medina, N.Y.
7/7 - 7/11	Olympic	New York, N.Y.
7/14 - 7/18	RCA (color sets)	Bloomington,Ind.
7/21 - 7/25	Curtis-Mathes	Athens, Tex.
7/23 - 7/25	Hoffman Products (Cortron Industries)	Orleans, Ind.
7/21 - 7/25	TMA	Wheeling, Ill.
7/29 - 8/1	Warwick	Forrest City, Ark.
7/28 - 8/1	Packard-Bell	Commerce, Calif.
7/29 - 8/1	Admiral	Harvard, Ill.
8/4 - 8/8	Magnavox	Greenville, Tenn.
8/4 8/8	Conrac	Los Angeles, Calif. (West Covina)
8/5 - 8/8	Symphonic	Lowell, Mass.
8/11 - 8/15	Setchell-Carlson	New Brighton, Minn.
8/11 - 8/15	RCA (monochrome sets)	Memphis, Tenn.
8/18 - 8/20	Zenith	Chicago, Ill.
8/18 - 8/22	General Electric	Syracuse, N.Y.
8/21 - 8/22	Sears (imported sets)	Chicago, Ill.
8/25 - 8/29	Westinghouse	Edison, N.J.
8/25 - 8/29	Andrea	New York, N.Y.

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APPENDIX B

PROCEDURES USED DURING 1969 IN-PLANT SURVEY FOR TESTING COLOR TELEVISION RECEIVERS FOR X-RADIATION EMISSIONS

PROCEDURES USED DURING 1969 IN-PLANT SURVEY
FOR TESTING COLOR TELEVISION RECEIVERS
FOR X-RADIATION EMISSIONS

1. List instruments to be used before leaving Survey Headquarters.

2. Obtain set description information from the receiver as called for on page 1 of the data sheets. Each tube "EIA No." and "Brand" should be copied from the tube in question. The EIA No., which denotes manufacturing source, will not always correspond to the brand as entered on the data sheets.

3. Check to see if chassis is grounded.

4. Ask if there is a higher KV connection on the transformer and note.

5. Have Manufacturer adjust all controls to give proper operation in home.

6. Connect test equipment to the receiver.

7. Place background reading on form.

8. Place the Victoreen 440F flush with the picture tube at its center.

9. Turn the receiver "on".

10. Increase the high voltage adjustment to its maximum position.

11. Increase the line voltage gradually from 120 VAC to 135 VAC varying brightness and CRT bias to obtain maximum emission.

12. Allow time for condition to stabilize.

13. Adjust the brightness control until a maximum x-ray reading is obtained on the most sensitive x-ray instrument, then measure with the 440 RF.

14. If no maximum reading, turn brightness to maximum value.

15. Record the picture tube voltage, picture tube current, and shunt regulator tube current (if applicable). Record the mA readings to the nearest hundredth and the kV readings to the nearest tenth.

16. Make a survey of the entire set with the Stoms meter to locate the area of maximum emission.

17. Record the location and the reading on the data sheet. Do not multiply the Stoms reading by 1000. Record the Stoms reading to the nearest hundredth, net of background.

18. Take a reading with the Victoreen 440 RF at the same location and record that value to the nearest tenth, net of background.

19. Adjust the brightness control for minimum brightness.

20. Repeat steps 15 - 18.

21. Turn the receiver "off".

22. Discharge the high voltage supply at the electrostatic voltmeter.

APPENDIX C

DATA CONTROL SYSTEM FOR THE IN-PLANT SURVEY OF TELEVISION RECEIVERS FOR X-RADIATION EMISSION CAPABILITY

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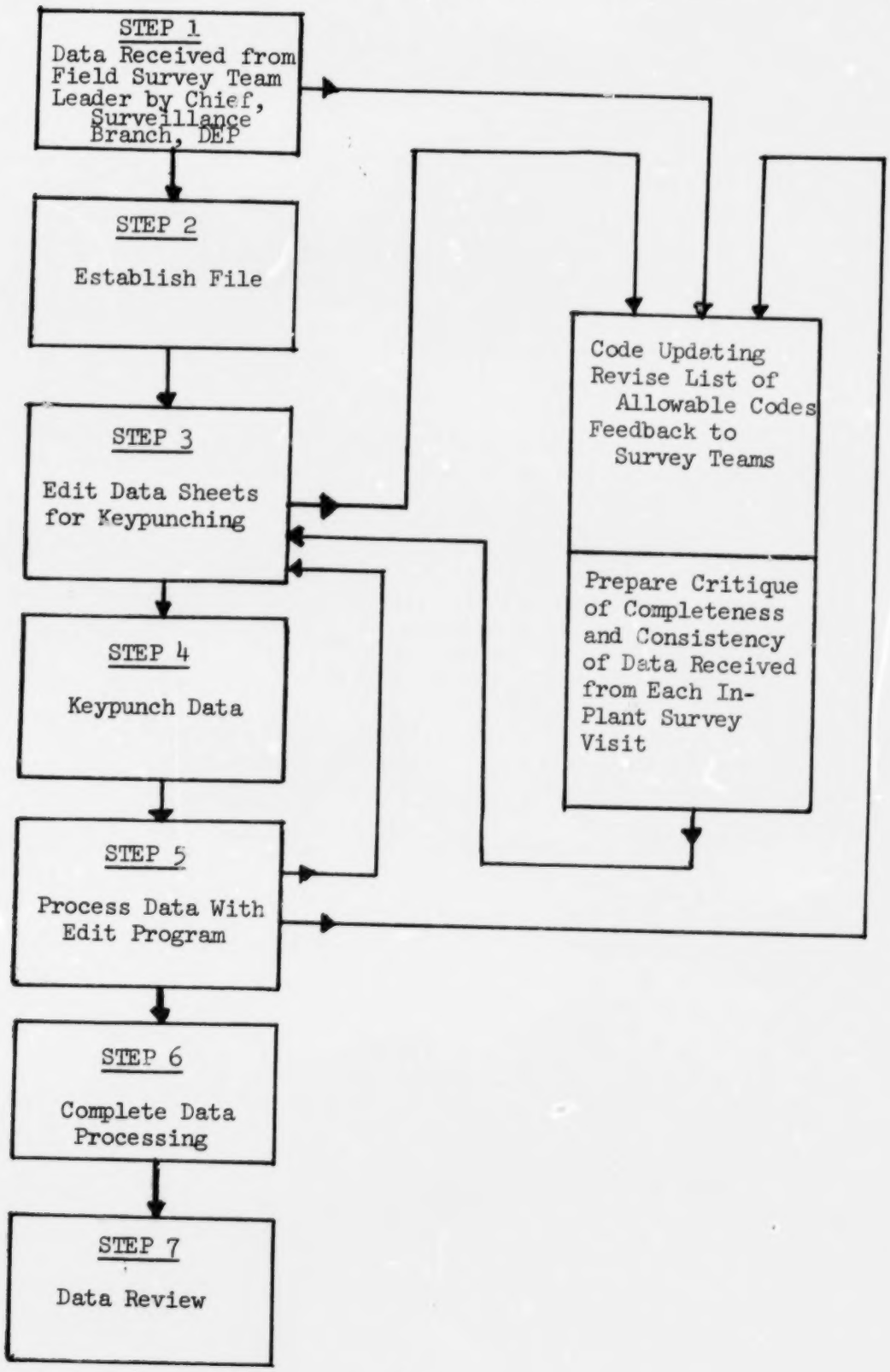
FLOW CHART



STEP 1

Data Received from Field Survey Team Leader by Chief, Surveillance Branch, DEP

A package containing survey data is mailed to the Chief, Surveillance Branch, DEP, after completion of a facility visit by the Survey Team Leader. The data package consists of data sheets which contain the measurements made on a selected group of television receivers and a Log Book. The Log Book contains the pertinent entries of each day's activities. These would include any unforseen circumstances which might alter the interpretation of the collected data.

Example of Memorandum: The following page contains a sample of the memorandum which is returned by the Survey Team Leader with the data package.

UNITED STATES GOVERNMENT

Memorandum

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
CONSUMER PROTECTION AND ENVIRONMENTAL HEALTH SERVICE
Environmental Control Administration

TO : Mr. Donald R. Smith, Chief
Surveillance Branch, DEP
12720 Twinbrook Parkway
Rockville, Maryland 20852

DATE:

FROM :

SUBJECT: Report of Testing of Color Television Receivers at _____

The data collected during the testing and evaluation of television receivers for X-radiation emission performed by _____, _____ and myself, at the _____ company's plant located at _____, from _____, 1969, through _____, is attached. In accordance with survey procedures, measurements for X-radiation emission data were made on _____ receivers. The total number of data sheets is _____. A copy of the list prepared by the manufacturer from which the receivers were selected is attached.

_____
Team Leader

STEP 2

Establish File

A file folder is established for each manufacturer as part of the Manufacturer's Data File for the Summer 1969 BRH In-Plant Survey of Television Receivers for X-radiation Emission Capability. Step 2 includes storing the following items in the Manufacturer's Data File:

1) a xerox of the original data sheets
2) the log book
3) all other material received from the Survey Team Leader

The original data sheets continue through Step 3 and 4 and are then filed. The xerox copy of the original data sheets provides a backup in case of loss and also serves as a record of the initial form of the data. This is important because the original data sheets are edited for consistency prior to computer processing. The following pages illustrate the material which is filed during Step 2.

Data Control Book

The Data Control Book maintains a record of the data sheets as they are processed through Step 6. As part of Step 2, the following entries are made into the Data Control Book.

1) the number of data pages received by the Data Editor
2) the facility the data pages were received from
3) the date the data pages were received

Page [1] of [ ]

TESTING AND EVALUATION OF COLOR TELEVISION RECEIVERS FOR X-RADIATION EMISSIONS

Test No. [ ]

Card Type [1]

DATA SHEETS

Card Seq. No. [1]

Manufacturer of Set: [ ]

Brand Name: [ ]

Import (Y = Yes, N = No): [ ]

Model Number: [ ]

Chassis Number: [ ]

Serial Number: [ ]

Cabinet Style: [ ]
(E = Home Entertainment Unit, P = Portable, C = Console, M = Other)

Cabinet Material: [ ]
(P = Plastic, M = Metal, W = Wood)

Production Date: [ ] [ ]
mo yr

Color (Y = Yes, N = No): [ ]

Card Seq. No. [2]

Picture Tube: [ ] [ ] [ ]
EIA No. brand type

Rectifier Tube: [ ] [ ] [ ]
EIA No. brand type

Shunt Regulator Tube: [ ] [ ] [ ]
EIA No. brand type

Survey Date: [ ] [ ] [ ]
mo day yr

Team: [ ]

Signature: _____

Coding Notes: See "DEP Company Codes" for coding of manufacturer names and brand names. Data should be left-justified. When data is not available, enter NA. If there is no shunt regulator tube, enter NONE for type.

Page [2] of [ ]

Test No. [ ]

Card Type [2]

MEASUREMENTS OF MAXIMUM RADIATION EMISSIONS

	Picture Tube	Minimum Brightness	Defective Shunt
Victoreen 440 RF (mR/hr)			
Stoms Meter (units)			
Picture Voltage, V_p (kV)			
Picture Current, I_p (mA)			
Shunt Current, I_s (mA)			
Location:			
Side (FR = Front, BK = Back, LT = Left, RT = Right, TP = Top, BT = Bottom)			
Maximum Dimension of Beam (L = larger than 2 inches, S = smaller than 2 inches)			
Section of Side (1-9; see coding guide on Location of Meter)			

Test Procedure for Further Tests: [ ]

(A. Normal procedure - all
B. Normal procedure - picture tube
C. Normal procedure - shunt regulator tube
D. Test with defective shunt regulator tube
E. No further tests to be made)

Signature: _____ Date: _____

Page [1] of [1]

Test No. [| | | |]

Card Type [3]

REGULATION AND OPERATING CONDITIONS DATA

Card Seq. No.	High Voltage Setting	Line Voltage V_L (V)	Shunt Current I_s (mA)	Picture Current I_p (mA)	Total Current I_t (mA)	Picture Voltage V_p (kV)
1						
2						
3						
4						
5						

Signature: _____ Date: _____

Page ⌊__⌋ of ⌊__⌋

Test No. ⌊____⌋

PICTURE TUBE DATA Card Type ⌊4⌋

Radiation - 0.5 mR/hr

Location of Meter ⌊___⌋

Card Seq.No.	Picture Voltage V_p (kV)	Picture Current I_p (mA)	Line Voltage V_L (V)		Picture Voltage V_p (kV)	Picture Current I_p (mA)	Line Voltage V_L (V)
⌊1⌋							
				⌊4⌋			
⌊2⌋							
				⌊5⌋			
⌊3⌋							

Signature:_____ Date:_____

Page [1] of [1]

Test No. [| | | |]

Card Type [5]

SHUNT REGULATOR TUBE DATA

Tube Type [| | | | | |]

Radiation = 0.5 mR/hr

DEP Code [| | | | | |]

Location of Meter [| | |]

Card Seq.No.	Shunt Voltage V_s (kV)	Shunt Current I_s (mA)	Line Voltage V_L (V)	Card Seq.No.	Shunt Voltage V_s (kV)	Shunt Current I_s (mA)	Line Voltage V_L (V)
1							
				4			
2							
				5			
3							

Signature: _____ Date: _____

EXAMPLE OF LOGBOOK

High Voltage Adjustment not directly accessible
Must bend up metal plate to alter high voltage.
This metal plate must be bent down or replaced to return set to original condition.
Also, high voltage adjustment not labeled.

Under normal conditions
1) Quick survey yielded no reading on Storms
2) Victoreen on faceplate yielded no reading

Procedure E

STEP 3

Edit Data Sheets for Keypunching

Data sheets are edited to insure that data is correct and in the required form for keypunching.

Data Control Book

For each test made on a TV receiver there is an entry made in the Data Control Book which shows the test number and the number of data pages. These are counted by the Data Editor.

STEP 3
(continued)

Edit Procedure for Data Sheets:

1. Card Types 1-5

   a) Check the first two digits of the test number against the "Facility Codes Used in Test Number" for correctness. (The Facility Codes sheet has been set up to avoid the use of corporate names and to facilitate the coding for computer programming.)

   b) Check that the second two digits of the test number are unique for each test and run sequentially so that the data sheets are not lost.

   c) Check page numbering for correctness.

2. Card Type 1

   a) Determine the correctness of the Division of Electronic Products codes that are not numeric.

   b) Check that all data fits within the allocated "boxes" for each particular part of the chassis being described.

3. Card Types 2-5

   Check that:

   a) All mA, kV, and Victoreen 440 RF readings consist of three digits.
      - mA readings are to two decimal places.
      - kV and Victoreen 440 RF readings are to one decimal place.

   b) The Stoms meter readings consist of four digits.
      - Stoms meter readings are recorded without multiplying the reading by a factor of 10^3 and are recorded to two decimal places.

   c) The data values are less than the maximum obtainable by the measuring instruments.

   d) All location coding is correct.

STEP 3
(continued)

4. Card Type 4

a) If the Picture Tube Data Sheet is used to take data in the defective shunt test, enter DDD for the location of the meter. The DDD indicates that the data is for a defective shunt test.

STEP 4

Keypunch Data

Deliver data sheets for keypunching. The keypunched data stored in the form of punched cards.

The maximum keypunch service available for this study is 1,000 cards/week. The punched cards are stored at DSMS (Data Systems and Mathematics Section) and a 80/80 listing of the data is stored in each manufacturer's data file folder.

The following pages are:

1) keypunch instructions (including field specifications)
2) a sample listing of the data
3) the keypunch sort procedure

STEP 4
(continued)

KEYPUNCH DECK SORT PROCEDURE

Card Type

1. Sort on CC 9.
   Those cards that fall into pockets 4 and 5 keep separate in specific piles.

Card Sequence No.

2. With the cards that fell into pocket 4 from the first sort, sort on CC 13.
   [Group II]

3. With the cards that fell into pocket 5 from the first sort, sort on CC 25.
   [Group III]

4. With remaining cards from the first sort, sort on CC 1Ø.
   [Group I]

Page No.

5. Put all the cards together with Group I on top and Group III on bottom.
   Sort on CC 2-1.

Test No.

6. Sort cards on CC 8-5.

56 SAMPLE

KEYPUNCH INSTRUCTIONS

Page 1-2 or 3,4

Test No. 5,6,7,8

Card Type 1 (9)

Right Justify

TESTING AND EVALUATION OF COLOR TELEVISION RECEIVERS FOR X-RADIATION EMISSIONS

1. Do not punch decimals.
2. Punch NA only for Card Type 1.
3. For card sequence No. 2 or greater, duplicate up to the card sequence number.

DATA SHEETS

Card Seq. No. (10) 1

Manufacturer of Set: 11–14 Left

Brand Name: 15–18 Justify

Import (Y = Yes, N = No): 20

Model Number: 22–31

Chassis Number: 35–45

Serial Number: 49–58

Cabinet Style: 62
(E = Home Entertainment Unit, P = Portable, C = Console, M = Other)

Cabinet Material: 64
(P = Plastic, M = Metal, W = Wood)

Production Date: 66,67 mo; 69,70 yr

Color (Y = Yes, N = No): 72 Purchased: (P = Yes) 80

Card Seq. No. (10) 2

Picture Tube: 11–14 EIA No.; 15–18 brand; 20–27 type

Rectifier Tube: 31–34 EIA No.; 36–39 brand; 41–46 type

Shunt Regulator Tube: 50–53 EIA No.; 55–58 brand; 60–65 type

Survey Date: 69,70 mo; 72,73 day; 75,76 yr

Team: 78

Signature: _____

Coding Notes: See "DEP Company Codes" for coding of manufacturer names and brand names. Data should be left-justified. When data is not available, enter NA. If there is no shunt regulator tube, enter NONE for type.

SAMPLE

1-2

Page [2] of [34]

Test No. [5 | | 8]

Card Type [2] [9]

MEASUREMENTS OF MAXIMUM RADIATION EMISSIONS

	Picture Tube	Minimum Brightness	Defective Shunt
Victoreen 440 RF (mR/hr)	11-13	14-16	17-19
Stoms Meter (units)	20-23	24-27	28-31
Picture Voltage, V_p (kV)	32-34	35-37	38-40
Picture Current, I_p (mA)	41-43	44-46	47-49
Shunt Current, I_s (mA)	50-52	53-55	56-58
Location:			
Side (FR = Front, BK = Back, LT = Left, RT = Right, TP = Top, BT = Bottom)	61-62	63-64	65-66
Maximum Dimension of Beam (L = larger than 2 inches, S = smaller than 2 inches)	67	68	69
Section of Side (1-9; see coding guide on Location of Meter)	71	72	73

Test Procedure for Further Tests:

(A. Normal procedure - all
B. Normal procedure - picture tube
C. Normal procedure - shunt regulator tube
D. Test with defective shunt regulator tube
E. No further tests to be made)

[75] [76]

Signature: _____ Date: _____

SAMPLE

Page 1-2 of 3,4

Test No. 5 | | 8

Card Type 3 9

REGULATION AND OPERATING CONDITIONS DATA

Card Seq. No.	High Voltage Setting	Line Voltage V_L (V)	Shunt Current I_s (mA)	Picture Current I_p (mA)	Total Current I_t (mA)	Picture Voltage V_p (kV)
10 1	12	13-15	16-18	19-21	22-24	25-27
	29	30-32	33-35	36-38	39-41	42-44
	46	47-49	50-52	53-55	56-58	59-61
	63	64-66	67-69	70-72	73-75	76-78
10 2	12					
3						
4						
5						

Signature: _____ Date: _____

SAMPLE

Page 12 of 34

Test No. 5 | | 8

Card Type 9 4

PICTURE TUBE DATA

Radiation - 0.5 mR/hr

Location of Meter 10 11 12

Card Seq.No.	Picture Voltage V_p (kV)	Picture Current I_p (mA)	Line Voltage V_L (V)		Picture Voltage V_p (kV)	Picture Current I_p (mA)	Line Voltage V_L (V)
13 1	14-16	17-19	20-22				
	23-25	26-28	29-31				
	32-34	35-37	38-40				
	41-43	44-46	47-49	13 4			
	50-52	53-55	56-58				
	59-61	62-64	65-67				
	68-70	71-73	74-76				
13 2	14-						
	23-						
				13 5			
13 3							

Signature: _____ Date: _____

SAMPLE

Page [17] of [34]

Test No. [5 | | 8]

Card Type [5 9]

SHUNT REGULATOR TUBE DATA

Tube Type [19 | | | | 15]

Radiation = 0.5 mR/hr

DEP Code [16 | | | | 21]

Location of Meter [22 | 24]

Card Seq.No.	Shunt Voltage V_s (kV)	Shunt Current I_s (mA)	Line Voltage V_L (V)		Shunt Voltage V_s (kV)	Shunt Current I_s (mA)	Line Voltage V_L (V)
25 1	26-28	29-31	32-34				
	35-37	38-40	41-43				
	44-46	47-49	50-52				
	53-55	56-58	59-61	25 4			
	62-64	65-67	68-70				
	71-73	74-76	77-79				
25 2	26-						
				25 5			
25 3							

Signature: _____ Date: _____

EXAMPLE OF 80/80 LISTING

```
01020 0111'      N
01020 0112185    25ZP22      188        3BT2                776908      C W 06 69 Y
02020 012 0  0   035 035      315320     018003                                  06 30 69 C
01020 0211.      N                                                  TPTP  LL  44  E
01020 0212101    19HFP22     188        3BT2                91533387    M M 06 69 Y
02020 022 0  0   0   0       325325     005003                                  06 30 69 C
01020 0311!      N                                                              E
01020 0312185    25ZP22      188        3BT2                739974      M M 04 69 Y
02020 032 0010 0 050 0       316336     048000                                  07 01 69 C
01020 0411.      N                                                  FR    L   5   E
01020 0412185    25ZP22      188        3BS2A               91367644    C W 01 69 Y
02020 042 0  0   0   0       205330     250002                                  07 01 69 C
01020 0511.      N                                                              E
01020 0512185    21GWP22                                    91775987    M M 06 69 Y
02020 052 0  0   0   0  0    250290     1100                                    070169  C
01020 0611!      Y                                                              E
01020 0612       15SP22                 3AT2                90401552    P M 06 69 Y
02020 062 0  0   0   0       220270     0880                                    07 01 69 C
01020 0711       N                                                              E
01020 0712185    25ZP22                                     91000998    C W 04 69 Y
02020 072 0  0   0   0       211307     1750                                    07 01 69 C
01090 0811       N                                                              E
01090 0812185    21GWP22     188        3BT2                91764709    M M 06 69 Y
02090 082 05 00  1000020     310332     050000                                  07 01 69 C
03090 0831 1110    000205 1110      010198 1110      020195 1110      FRFR  LL  55  B  030189
03090 0832 1110    050182 1110      075173 1115      000215 1115               010210
03090 0833 1115    020204 1115      030200 1115      050192 1115               084180
03090 0834 1120    000224 1120      010218 1120      020212 1120               030207
03090 0835 1125    050201 1125      090186 1125      000234 1125               010227
04090 0831 1   125  2222 1      125  3218 1      125  5211 1               125097193
04090 0832 1   130000243 1      130010238 1      130020233 1               130030227
04090 0833 1   130050220 1      130100203 1      130105200 1               135000252
04090 0834 1   135010246 1      135020242 1      135030237 1               135050230
04090 0835 1   135100212 1      135140199 2      120000242 2               120010236
05090 0831 2110    020230 2110      030225 2110      050219 2110               100200
05090 0832 2110    108197 2115      000253 2115      010246 2115               020242
05090 0833 2115    030236 2115      050230 2115      100212 2115               120204
05090 0834 2120    000265 2120      010257 2120      020255 2120               030251
05090 0835 2120    050242 2120      100225 2120      133213 2125               000277
06090 0831 2125    010270 2125      020266 2125      030261 2125               050255
06090 0832 2125    100235 2125      145222 2130      000287 2130               010281
06090 0833 2130    020277 2130      030272 2130      050265 2130               100247
06090 0834 2130    150231 2130      155229 2135      000298 2135               010291
06090 0835 2135    020286 2135      030282 2135      050273 2135               100256
07090 0831 2135    150240 2135      160237 3110      000266 3110               010259
07090 0832 3110    020256 3110      030250 3110      050239 3110               100217
07090 0833 3115    000280 3115      010272 3115      020268 3115               030264
07090 0834 3115    050256 3115      100234 3115      110227 3120               000293
07090 0835 3120    010287 3120      020283 3120      030276 3120               050267
08090 0831 3120    100244 3120      120236 3125      000306 3125               010299
08090 0832 3125    020293 3125      030289 3125      050278 3125               100258
08090 0833 3125    130245 3130      000320 3130      010315 3130               020307
08090 0834 3130    030304 3130      050293 3130      100270 3130               110265
08090 0835 3135    000331 3135      010326 3135      020320 3135               030315
09090 0831 3135    040310 3135      050306 3135      100280 3135               115273
01020 0911       N                                          91464424    P P 05 69 Y
01020 0912101    17FAP22     188        3BT2                                    07 01 69 C
```

STEP 5

Process Data With
Edit Program

Execute edit check program.

NOTE: It may be necessary to repunch data cards at this point to eliminate coding errors which may have occurred.

STEP 5
(continued)

OPERATIONS OF EDIT CHECK PROGRAM

DATA CHECKS FOR CARD TYPE 1

A. Checks for Coding:

Item Coded	Code Criteria
Manufacturer of Set	It is as shown on the "DEP COMPANY CODES" chart prepared for this study
Brand Name	" " " " " " " " " " " "
Picture Tube Brand	" " " " " " " " " " " "
Rectifier Tube Brand	" " " " " " " " " " " "
Shunt Regulator Tube Brand	" " " " " " " " " " " "
Import	Y or N
Cabinet Style	E, P, C, or M
Production Date (mo, yr)	1-12, 55-69
Picture Tube EIA No.	The picture tube shown on the form corresponds with the EIA Source Codes
Rectifier Tube EIA No.	" " " " " " " " " "
Shunt Regulator Tube EIA No.	" " " " " " " " " "
Survey Date (mo, day, yr)	1-12, 1-31, 69
Team	A, B, or C
First two digits of Test No.	Check against Facility Code used by surveyors and listed in the Procedural Manual

The form of the punched card error message is as follows:

Test No.
(10x, I4, 2x, 6A4, 16 H CODED IMPROPERLY)

For example: 2202 Manufacturer of Set Coded Improperly

B. Consistency Checks:

Match:	With:
Picture Tube Brand	EIA No. using "EIA Source Codes"
Rectifier Tube Brand	" " " " " "
Shunt Regulator Tube Brand	" " " " " "

Form of punch card error message

For example: 2202 Picture Tube Brand Differs from Manufacturer EIA No.

EXAMPLE OF EDIT CHECK PROGRAM

0	01	SHUNT REGULATOR TUBE BRAND	CODED IMPROPERLY
0	01	SHUNT REGULATOR TUBE EIA NO.	CODED IMPROPERLY
0	01	SHUNT REGULATOR TUBE BRAND	INCONSISTENT WITH EIA SOURCE CODES
02020	01	CARD 1	CODED IMPROPERLY
0	02	SHUNT REGULATOR TUBE BRAND	CODED IMPROPERLY
0	02	SHUNT REGULATOR TUBE EIA NO.	CODED IMPROPERLY
0	02	SHUNT REGULATOR TUBE BRAND	INCONSISTENT WITH EIA SOURCE CODES
02020	02	CARD 1	CODED IMPROPERLY
0	03	SHUNT REGULATOR TUBE BRAND	CODED IMPROPERLY
0	03	SHUNT REGULATOR TUBE EIA NO.	CODED IMPROPERLY
0	03	SHUNT REGULATOR TUBE BRAND	INCONSISTENT WITH EIA SOURCE CODES
02020	03	CARD 1	CODED IMPROPERLY
0	04	RECTIFIER TUBE BRAND	CODED IMPROPERLY
0	04	SHUNT REGULATOR TUBE BRAND	CODED IMPROPERLY
0	04	SHUNT REGULATOR TUBE EIA NO.	CODED IMPROPERLY
0	04	RECTIFIER TUBE BRAND	INCONSISTENT WITH EIA SOURCE CODES
0	04	SHUNT REGULATOR TUBE BRAND	INCONSISTENT WITH EIA SOURCE CODES
02020	04	CARD 1	CODED IMPROPERLY
0	05	RECTIFIER TUBE BRAND	CODED IMPROPERLY
0	05	SHUNT REGULATOR TUBE BRAND	CODED IMPROPERLY
0	05	RECTIFIER TUBE EIA NO.	CODED IMPROPERLY
0	05	SHUNT REGULATOR TUBE EIA NO.	CODED IMPROPERLY
0	05	SURVEY DATE	CODED IMPROPERLY
0	05	RECTIFIER TUBE BRAND	INCONSISTENT WITH EIA SOURCE CODES
0	05	SHUNT REGULATOR TUBE BRAND	INCONSISTENT WITH EIA SOURCE CODES
02020	05	CARD 1	CODED IMPROPERLY
0	06	MANUFACTURER OF SET	CODED IMPROPERLY
0	06	PICTURE TUBE BRAND	CODED IMPROPERLY
0	06	RECTIFIER TUBE BRAND	CODED IMPROPERLY
0	06	SHUNT REGULATOR TUBE BRAND	CODED IMPROPERLY
0	06	PICTURE TUBE EIA NO.	CODED IMPROPERLY
0	06	RECTIFIER TUBE EIA NO.	CODED IMPROPERLY
0	06	SHUNT REGULATOR TUBE EIA NO.	CODED IMPROPERLY
0	06	PICTURE TUBE BRAND	INCONSISTENT WITH EIA SOURCE CODES
0	06	RECTIFIER TUBE BRAND	INCONSISTENT WITH EIA SOURCE CODES
0	06	SHUNT REGULATOR TUBE BRAND	INCONSISTENT WITH EIA SOURCE CODES
02020	06	CARD 1	CODED IMPROPERLY
0	07	RECTIFIER TUBE BRAND	CODED IMPROPERLY
0	07	SHUNT REGULATOR TUBE BRAND	CODED IMPROPERLY
0	07	RECTIFIER TUBE EIA NO.	CODED IMPROPERLY
0	07	SHUNT REGULATOR TUBE EIA NO.	CODED IMPROPERLY
0	07	RECTIFIER TUBE BRAND	INCONSISTENT WITH EIA SOURCE CODES
0	07	SHUNT REGULATOR TUBE BRAND	INCONSISTENT WITH EIA SOURCE CODES
02020	07	CARD 1	CODED IMPROPERLY
0	08	SHUNT REGULATOR TUBE BRAND	CODED IMPROPERLY
0	08	SHUNT REGULATOR TUBE EIA NO.	CODED IMPROPERLY
0	08	SHUNT REGULATOR TUBE BRAND	INCONSISTENT WITH EIA SOURCE CODES
02090	08	CARD 1	CODED IMPROPERLY
0	09	SHUNT REGULATOR TUBE BRAND	CODED IMPROPERLY
0	09	SHUNT REGULATOR TUBE EIA NO.	CODED IMPROPERLY
0	09	SHUNT REGULATOR TUBE BRAND	INCONSISTENT WITH EIA SOURCE CODES
02020	09	CARD 1	CODED IMPROPERLY
0	10	RECTIFIER TUBE BRAND	CODED IMPROPERLY
0	10	SHUNT REGULATOR TUBE BRAND	CODED IMPROPERLY

STEP 6

Complete Data Processing

Process the data with the listing program and the plot programs. Deliver the final display and data to the Chief, Surveillance Branch, DEP.

STEP 7

Data Review

The data are reviewed by the Surveillance Branch of the Division of Electronic Products. Decisions are made as to the action or the recommendations concerning each company. Decisions are also made whether or not to buy certain TV receivers which exhibit X-radiation exposure rates greater than 0.5 mR/hr. The reasons for the decisions are noted in the file for the 1969 in-plant survey.

EXAMPLE OF COMPLETE LISTING OF DATA

EST 01 25 July

MANUFACTURER		BRAND	(COLOR)	PRODUCTION DATE 06/69
CHASSIS NO.		SERIAL NO.776908		MODEL
PICTURE TUBE		RECTIFIER		SHUNT NONE
WOOD	CONSOLE	SURVEY DATE 06/30/69		SURVEY TEAM C

MAXIMUM RADIATION MEASUREMENTS

	VICTOREEN (MR/HR)	STOMS (UNITS)	PICTURE KV	PICTURE MA	SHUNT MA	METER LOCATION
PICTURE TUBE	0	00.35	31.5	0.18		TPL4
MIN BRIGHTNESS	0	00.35	32.0	0.03		TPL4
DEFECTIVE SHUNT						

E. NO FURTHER TESTS TO BE MADE

TEST 02

MANUFACTURER		BRAND	(COLOR)	PRODUCTION DATE 06/69
CHASSIS NO.		SERIAL NO.91533387		MODEL
PICTURE TUBE		RECTIFIER		SHUNT NONE
METAL	OTHER	SURVEY DATE 06/30/69		SURVEY TEAM C

MAXIMUM RADIATION MEASUREMENTS

	VICTOREEN (MR/HR)	STOMS (UNITS)	PICTURE KV	PICTURE MA	SHUNT MA	METER LOCATION
PICTURE TUBE	0	0	32.5	0.05		
MIN BRIGHTNESS	0	0	32.5	0.03		
DEFECTIVE SHUNT						

E. NO FURTHER TESTS TO BE MADE

TEST 03

MANUFACTURER		BRAND	(COLOR)	PRODUCTION DATE 04/69
CHASSIS NO.		SERIAL NO.739974		MODEL
PICTURE TUBE		RECTIFIER		SHUNT NONE
METAL	OTHER	SURVEY DATE 07/01/69		SURVEY TEAM C

MAXIMUM RADIATION MEASUREMENTS

	VICTOREEN	STOMS	PICTURE	PICTURE	SHUNT	METER

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APPENDIX D

CODES FOR LOCATION OF METER

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CODES FOR LOCATION OF METER

BOTTOM (BT)

1	2	3
4	5	6
7	8	9

TOP (TP)

1	2	3
4	5	6
7	8	9

LEFT (LT)

1	2	3
4	5	6
7	8	9

RIGHT (RT)

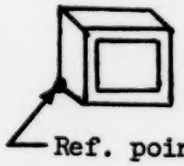
1	2	3
4	5	6
7	8	9

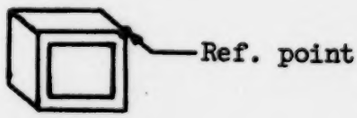
BACK (BK)

1	2	3
4	5	6
7	8	9

FRONT (FR)

1	2	3
4	5	6
7	8	9





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D. R. Smith, S. E. Reiter, and
T. M. Smith:
IN-PLANT SURVEY OF TELEVISION
RECEIVERS FOR X-RADIATION EMISSION CAPABILITY.
U.S. Department of Health, Education, and Welfare,
Public Health Service Publication Number BRH/DEP 70-24
(September 1970), 71 pp. (limited distribution).

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ABSTRACT: Visits were made to the facilities of 21 domestic television manufacturers and one retailer of foreign receivers to measure x-radiation emissions from television receivers considered typical of those being marketed since the effective date of the Radiation Control for Health and Safety Act of 1968. The test data obtained during these visits provided basic information on the capability of the receivers to emit

(over)

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DIVISION OF ELECTRONIC PRODUCTS

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(continued from inside of front cover)

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BRH/DEP 70-23	Microwave Oven Test Load Evaluation and Determination of Internal Microwave Energy Distribution	
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